STP UPGRADES PRELIMINARY DESIGN

DESIGN REVIEW PRESENTATION

Prepared for Town of Lake Cowichan| October 2025

Preliminary Design Phase Scope

1. Confirm Design Basis
2. Conduct Geotechnical Investigations and Site Survey to support Design
3. Confirm Preferred Option for Phosphorus Removal
4. Confirm Preferred Option for Effluent Disinfection
5. Confirm Preferred Method for Lagoon Sludge Management
6. Advance Preliminary Design of Selected Upgrades
7. Consult with Ministry to determine requirements for permit Amendment or Registration under the MWR

Project History

2009

<u>Original Pre-Design</u>

Stage 1 :

- Lagoon Expansion
- Aeration Upgrades
- New Headworks

Stage 2:

- Phosphorus Removal
- Disinfection Upgrades

2014

<u>Upgrade Phasing Plan</u>

Stage 1 Phae 1:

- Lagoon Cell 3 Expansion

Stage 1 Phase 2:

- Cell 3 Hydraulic Connection
- New Headworks
- Aeration Upgrades

Stage 2: Future upgrade to be determined*

2015

Construction of Lagoon Cell 3 Expansion

2022

1. Cost Estimate Update
2. Grant Application

SUMMER 2023

Cowichan River Fish Mortality Event

2023

1. Grant Approval
2. Preliminary Design Awarded (December)

Jan 2024

1. Preliminary Design Initiation
2. Notification of 2023 Fish Mortality Event and Regulatory Support

Project History

March 2024

1. Permit Amendment Application for Permanent Upgrades

Feb 2024

1. Requirement for Interim Upgrades Identified
2. Permit Amendment Application for Interim Upgrades

Mar-Jun 2024

1. Recommendations for Interim Upgrades
2. Design of Interim Upgrades
3. Permit Amendment for Interim Upgrades
4. Construction and Commissioning of Interim Upgrades Construction

Jul-Aug 2024

1. Ongoing Operational Support
2. Lagoon De-sludging Proposal Solicitation, Review and Recommendation for Award

Jul-Aug 2024

1. Preliminary Design Progression – Option Evaluations and Headworks Design
2. Site Survey

Dec 2024

1. Permit Amendment Pre-Application Meeting
2. Confirmation of MWR Registration and requirement for Environmental Imact Study

Jan 2025

1. EIS Proposal Submitted
2. Geotechnical Investigations completed

Project History

May 2025

1. EIS Proposal Approval and Initiation

Jun 2025

1. Draft Preliminary Design Workshop with Town

Jun 2025

1. Notice from Ministry of Permit Amendment
2. Ministry Issued New Permit Amendment

2025 Jul-Sep

1. Alum Dosing Optimization and Recommendations
2. Contingency Plan Preparation
3. Regulatory Support
4. Operations and Monitoring Support

October 2025

1. Preliminary Design Completion

DESIGN BASIS

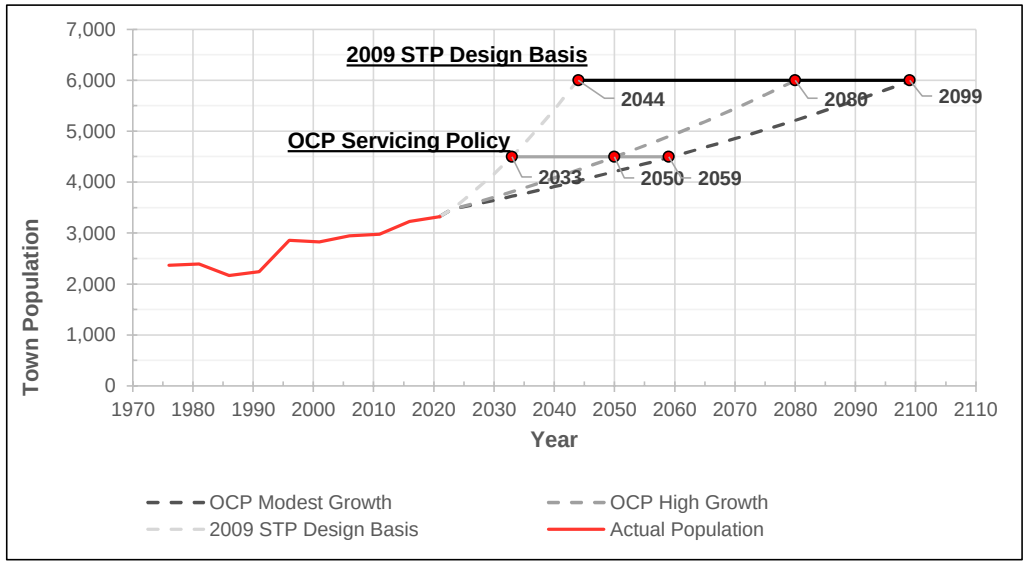
STP UPGRADE MAIN OBJECTIVES

1. Improve Quality of Treated Effluent Discharged to Cowichan River
2. Accommodate Population Growth
3. Address Operational Issues

STP UPGRADE MAIN CHALLENGES

1. Budget Constraints
2. Hydraulic Constraints
3. Stringent Effluent Criteria for Phosphorus 0.25 mg/L
4. Evolving Regulatory Requirements and Pressures
5. Cowichan River Flow Reductions
6. Pending Results of Environmental Impact Study

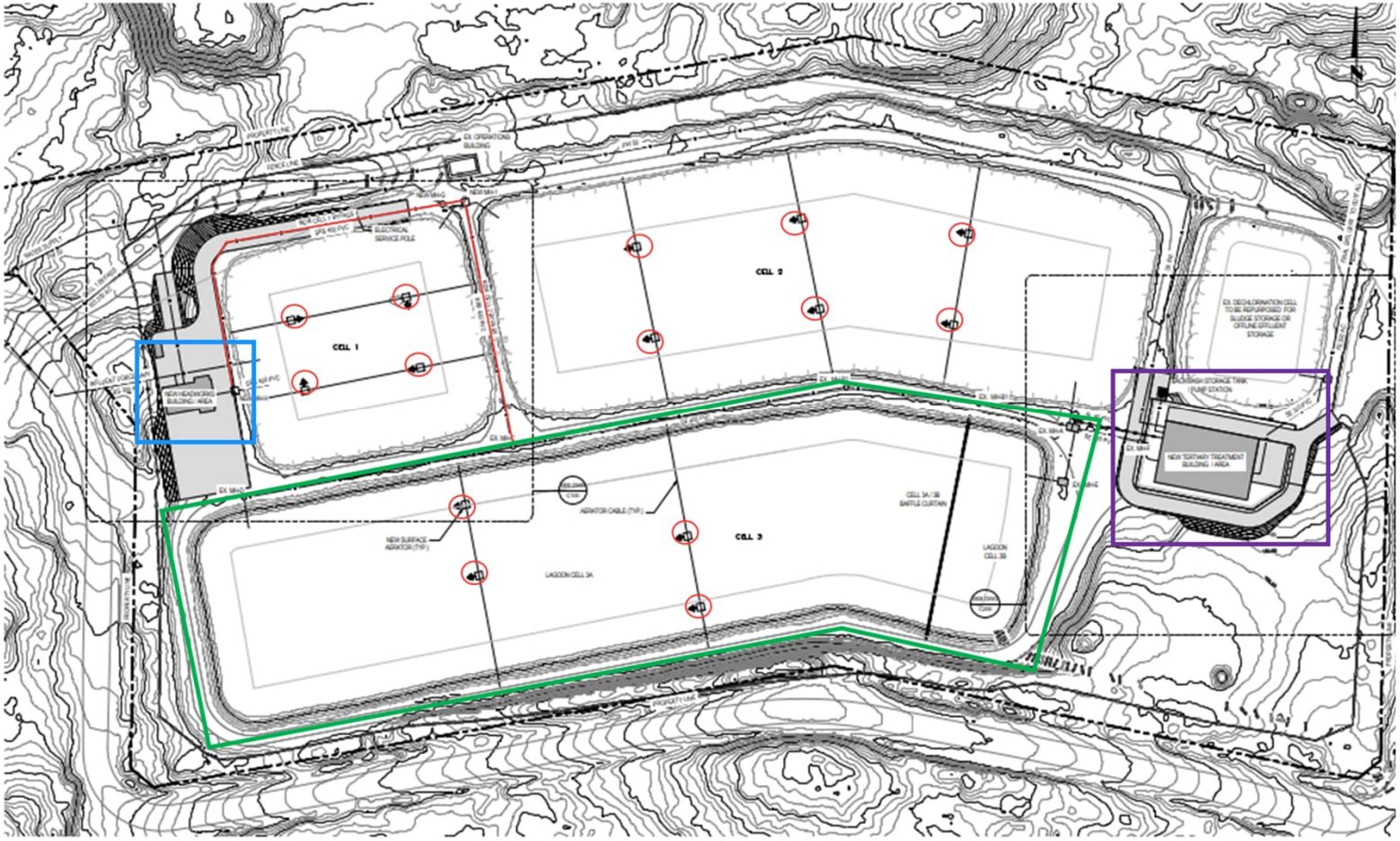
POPULATION DESIGN BASIS



GROWTH SCENARIO	GROWTH RATE	POPULATION = 6,000 DESIGN HORIZON		POPULATION 4,500 DESIGN HORIZON	
	(%/Year)	(# Years)	(Design Year)	(# Years)	(Design Year)
OCP Modest Growth	0.7%	71	2099	31	2059
OCP High Growth	1.0%	52	2080	22	2050
2009 STP Pre-Design Basis	2.7%	16	2044	5	2033
Average Growth Rate	1.5%	33	2061	13	2041

STP UPGRADE COMPONENTS

1. New Headworks/screening Facility
2. Lagoon Cell 3 Expansion and Hydraulic Connection (complete)
3. Aeration Upgrades and Piping Modifications
4. Phosphorus Removal
5. Disinfection Upgrade

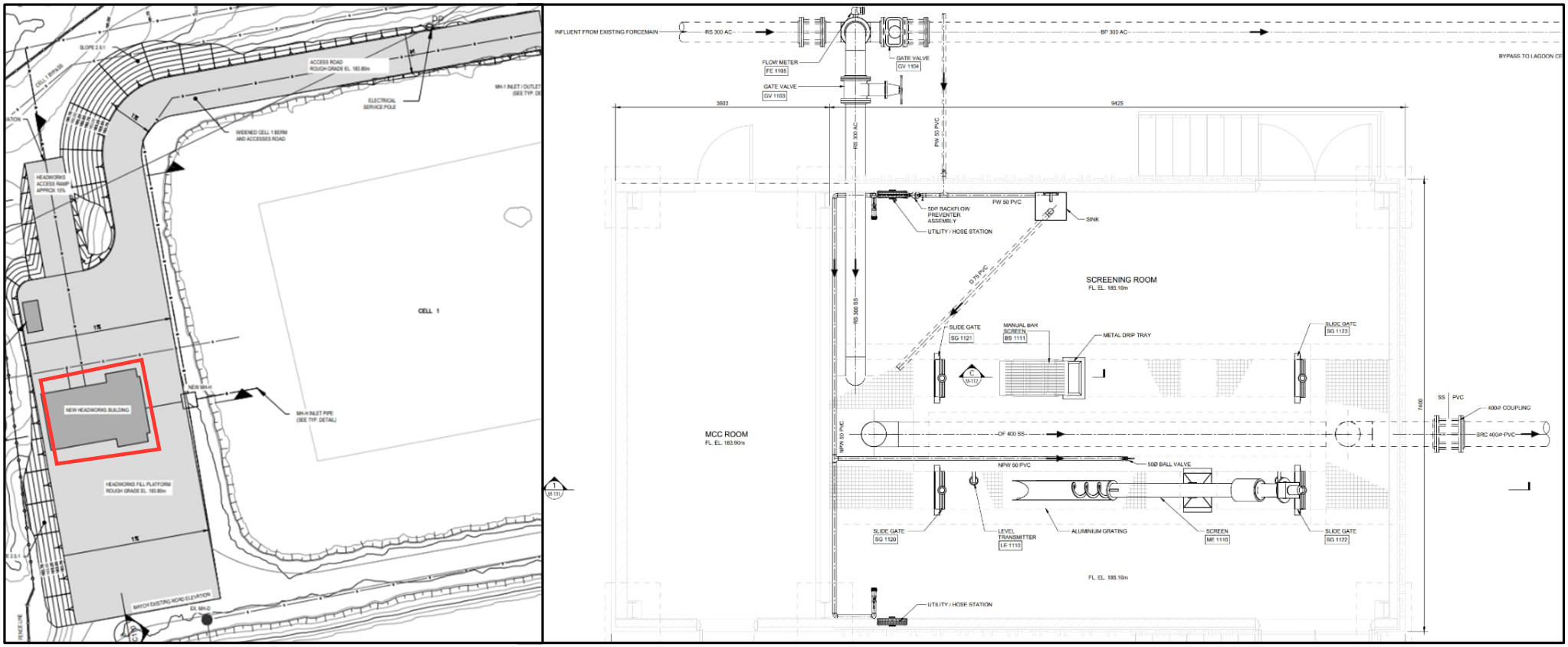


HEADWORKS

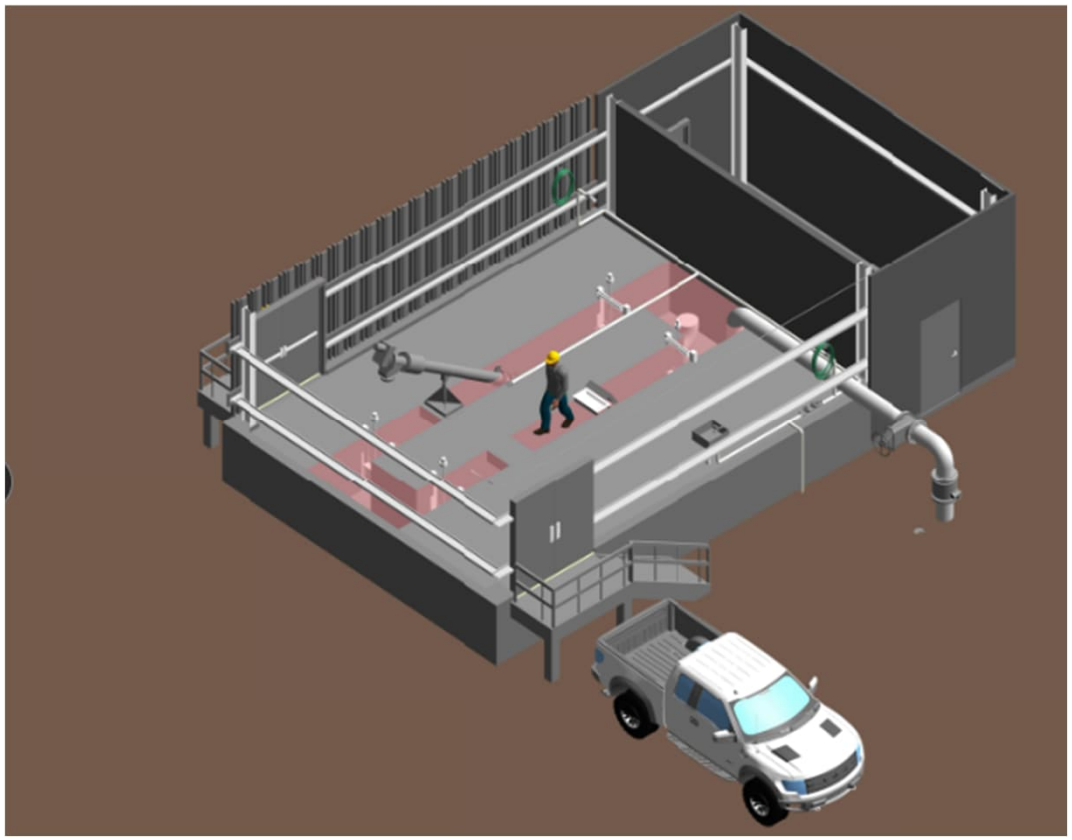
Headworks: Key Drivers and Objectives

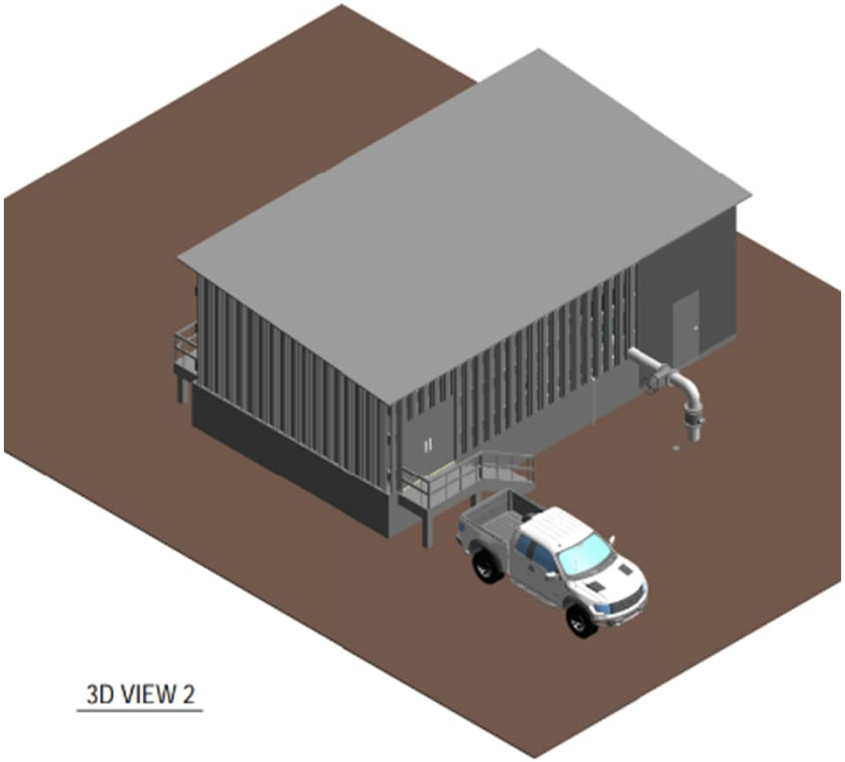
1. Eliminate Operational Issues with Large Solids
2. Reduce Contaminant Loading to Lagoons
3. Reduce sludge / solids build-up in Primary Lagoon Cell

Headworks: Preliminary Design Overview



Headworks: Preliminary Design Overview

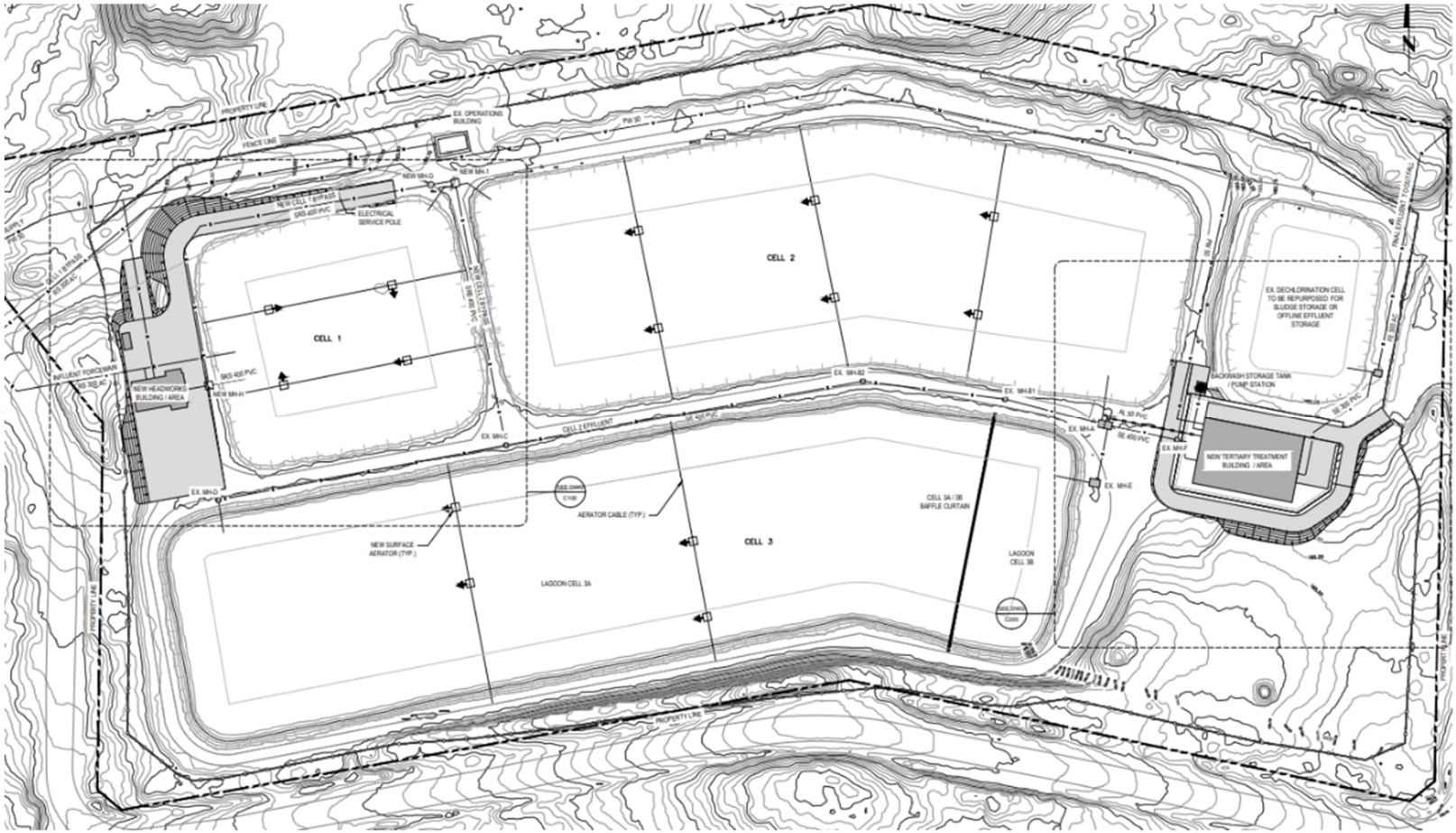




LAGOON UPGRADES

Lagoon Upgrades: Key Drivers and Objectives

1. Provide full aeration in Cell 3
2. Upgrade Aerators in Cells 1 and 2
3. Piping changes to enhance operational flexibility
4. Enhance solids retainment in Cell 3
5. Reduce potential for Algae Growth in Cell 3
6. Enhance Ammonia Removal


CELL 1
CELL 2
CELL 3
EX. OPERATIONS BUILDING
ELECTRICAL SERVICE POLE
NEW HEADWORKS BUILDING / AREA
EX. GEOCHLORINATION CELL TO BE REPURPOSED FOR SLUDGE STORAGE OR OFFLINE EFFLUENT STORAGE
BACKWASH STORAGE TANK / PUMP STATION
NEW TERTIARY TREATMENT BUILDING / AREA
CELL 3A / 3B BAFFLE CURTAIN
AERATOR CABLE (TYP.)
NEW SURFACE AERATOR (TYP.)
LAGOON CELL 3A
LAGOON CELL 3B
PROPERTY LINE
FENCE LINE

PHOSPHORUS REMOVAL

Phosphorus Removal: Key Drivers and Objectives

1. Reliably achieve low phosphorus levels to meet special limit for Cowichan River (0.25 mg/L)
2. Simple to Operate and Maintain
3. Low Capital and O&M Costs
4. Ease of implementation and expandability

Phosphorus Removal: Options Analysis

Option 1: Biological Phosphorus Removal (BPR)

- Difficult to implement in existing lagoons
- Requires taking lagoons “offline”
- Operationally sensitive and lowest reliability
- Operationally intensive
- High Capital Cost
- High O&M Cost
- Doesn’t produce effluent to meet required limit and still requires filtration step

Option 2: Chemical Phosphorus Removal + Disc Filtration

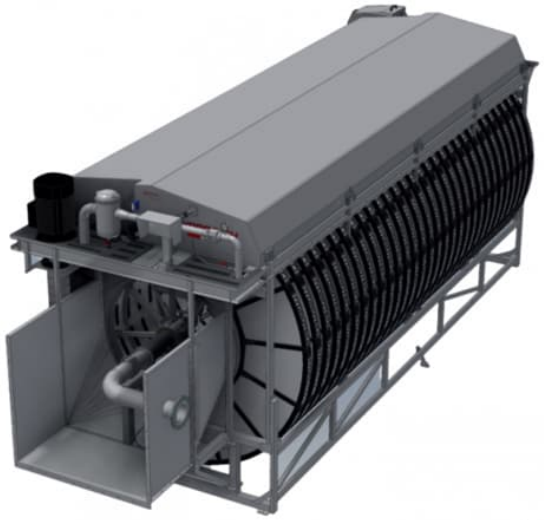
- No pumping requirement
- Ease of implementation/construction
- Simplest to operate/maintain
- High process reliability
- Can meet or exceed effluent phosphorus limits
- Lowest Capital Cost
- Lowest O&M Cost

Option 3: Chemical Phosphorus Removal + Continuous Up-flow Sand Filtration (CUFSF)

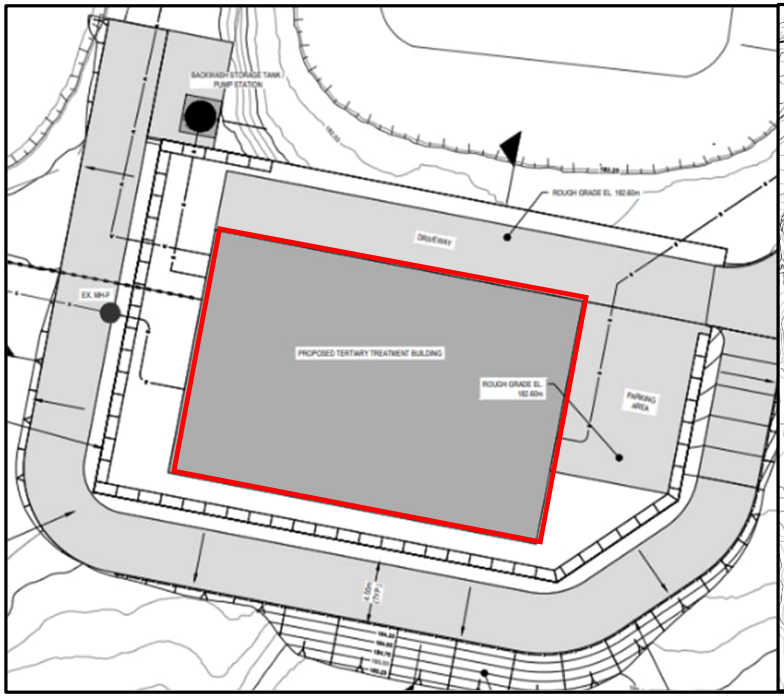
- Requires pumping of lagoon effluent to CUFSF process
- Operationally complex and Maintenance Intensive
- High Process Reliability
- Provides lowest effluent phosphorus levels
- Highest Capital Cost
- High O&M cost

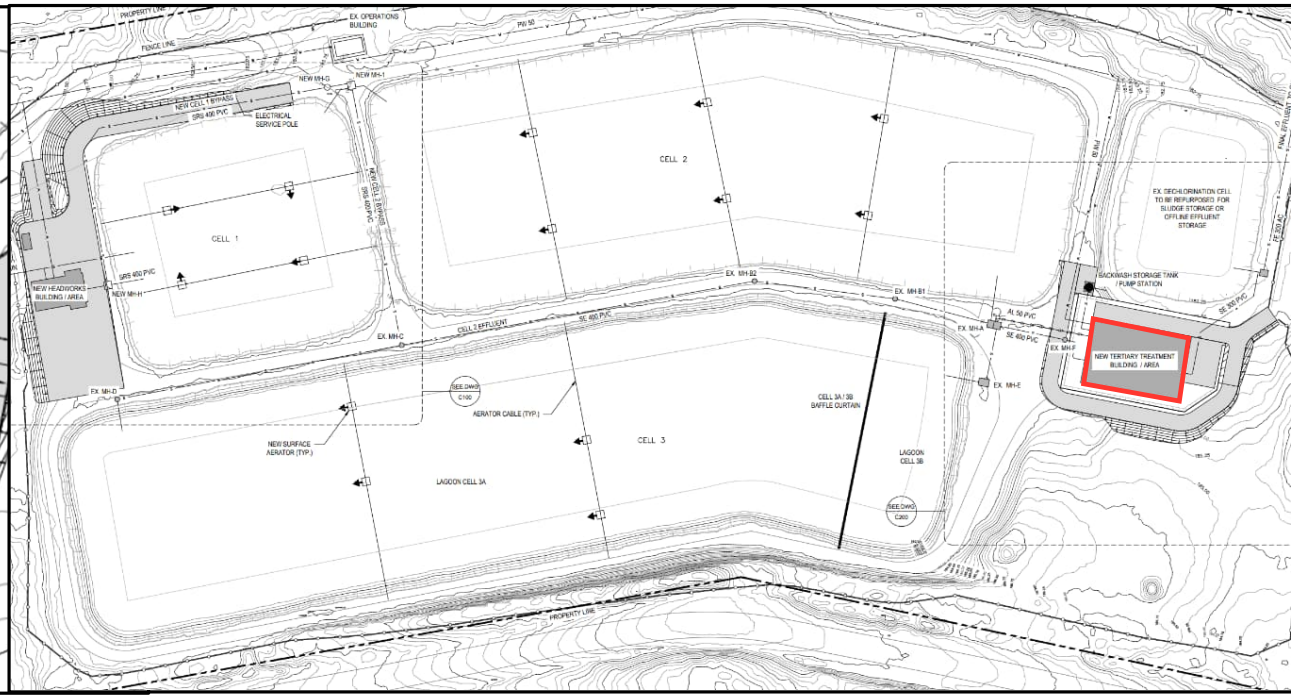
Phosphorus Removal: Preferred Option

- **Option 2: Chemical Phosphorus Removal + Disc Filtration determined to be preferred Option**
- High reliability to achieve required phosphorus levels
- Simple to Operate and Maintain
- Ease of Implementation
- Lowest Capital Cost (-Δ$2M)
- Lowest O&M Costs

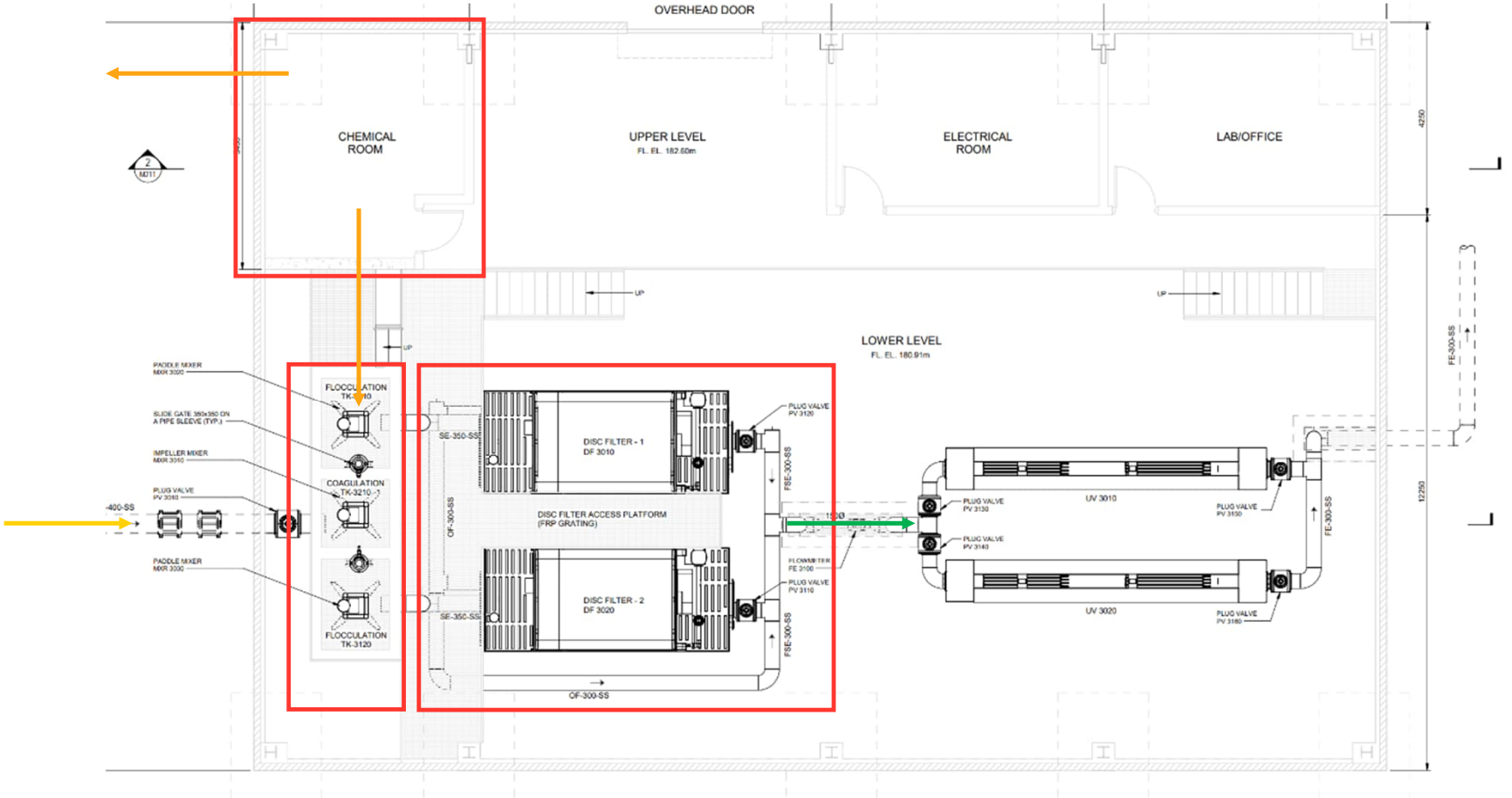


Phosphorus Removal: Preliminary Design Overview

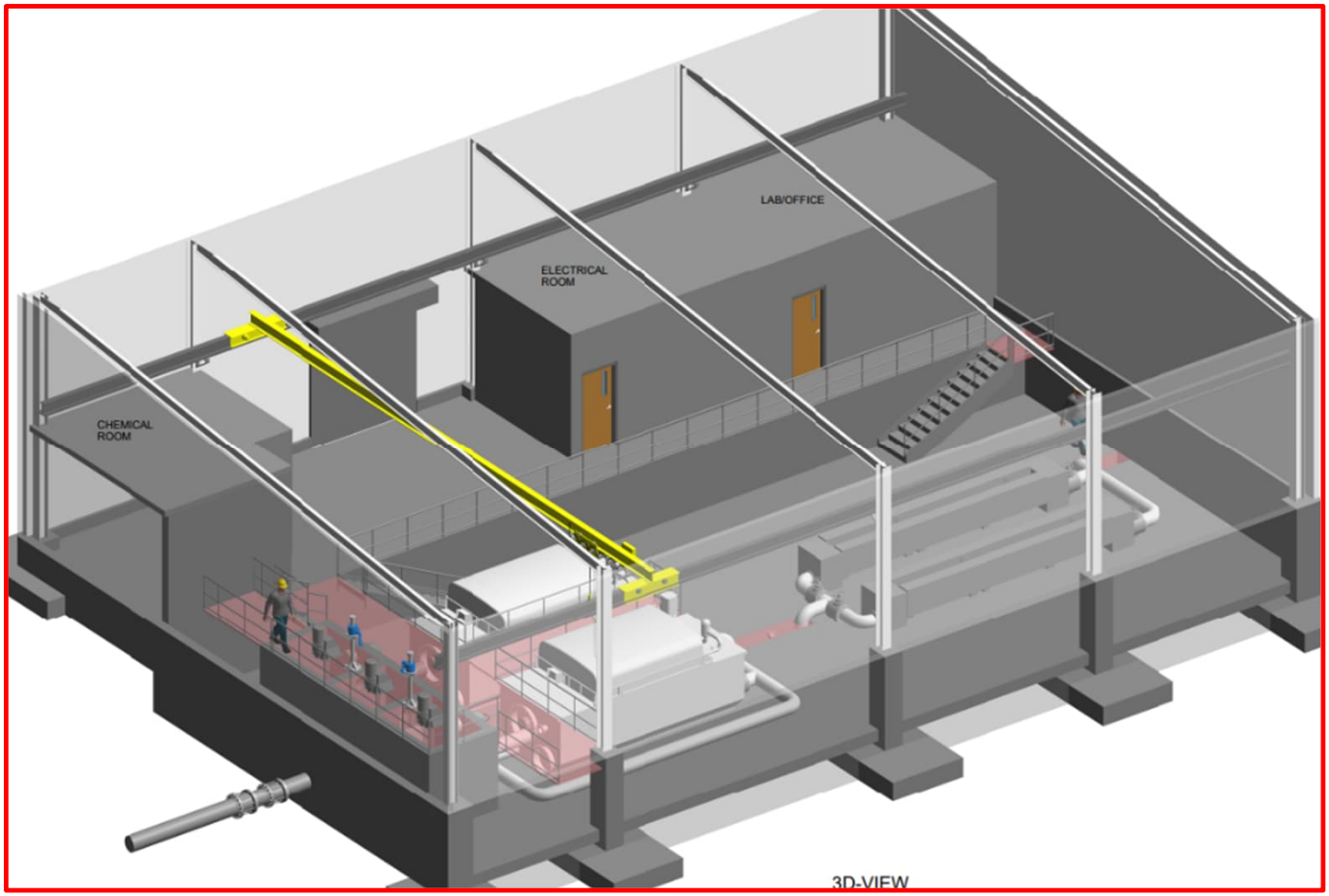




Phosphorus Removal: Preliminary Design Overview



Phosphorus Removal: Preliminary Design Overview



DISINFECTION

Disinfection: Key Drivers and Objectives

1. **Expansion required to meet future design flows**
2. **Meet Redundancy requirement**
3. **Address Current Regulatory Context for Use of Chlorine Disinfection**

- Provincial: MWR 52(2)

A discharger must not use chlorination to disinfect municipal effluent without authorization from a director unless

(a) the discharger first considers alternative disinfection methods, and

(b) the municipal effluent discharged to surface water is dechlorinated below 0.02 mg/L total residual chlorine before discharge

- Federal

Chlorinated wastewater effluents classified as a priority substance and concluded that chlorinated wastewater effluents are “toxic” as defined under Paragraph 11(a) of the Canadian Environmental Protection Act

Chlorine is toxic to aquatic organisms so it must be removed from wastewater before it is discharged to lakes, rivers and oceans. Since the implementation of the Strategy, governments have moved away from using chlorine in favour of other methods of disinfection.

The National Performance Standard for total residual chlorine is 0.02 mg/L.

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Disinfection Options Analysis

Option 1: Expand Existing Chlorine Disinfection Facility

- Familiar to Operators
- Requires significant civil/concrete works for new tank
- Operationally Intensive and enhanced daily sampling
- Difficult dosing control
- Requires chemical purchase, handling, and storage
- Higher O&M Cost (chemical, sampling)
- Higher Capital Cost/Complexity
- Risk of toxicity from disinfection byproducts
- Discouraged under current regulatory context

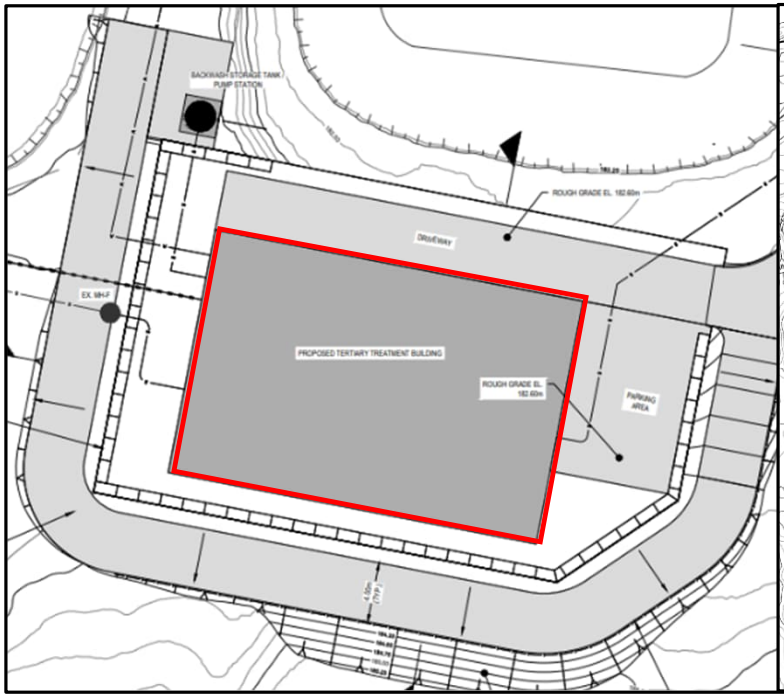
Option 2: Ultraviolet (UV) Disinfection

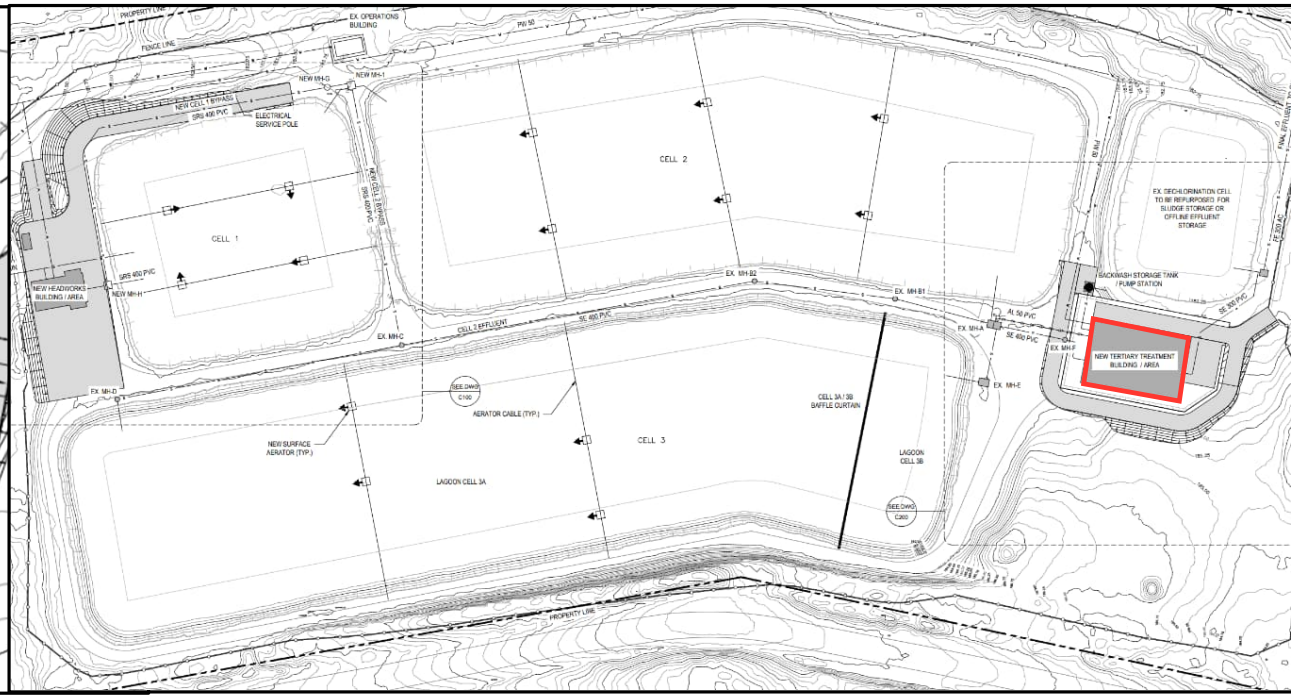
- Ease of implementation/construction
- Ease of expansion
- Simple to operate – no additional daily sampling
- No chemical
- Low Capital Cost
- Lower O&M Cost
- No disinfection byproducts/toxicity
- Supported by current regulatory context

Disinfection: Preferred Option

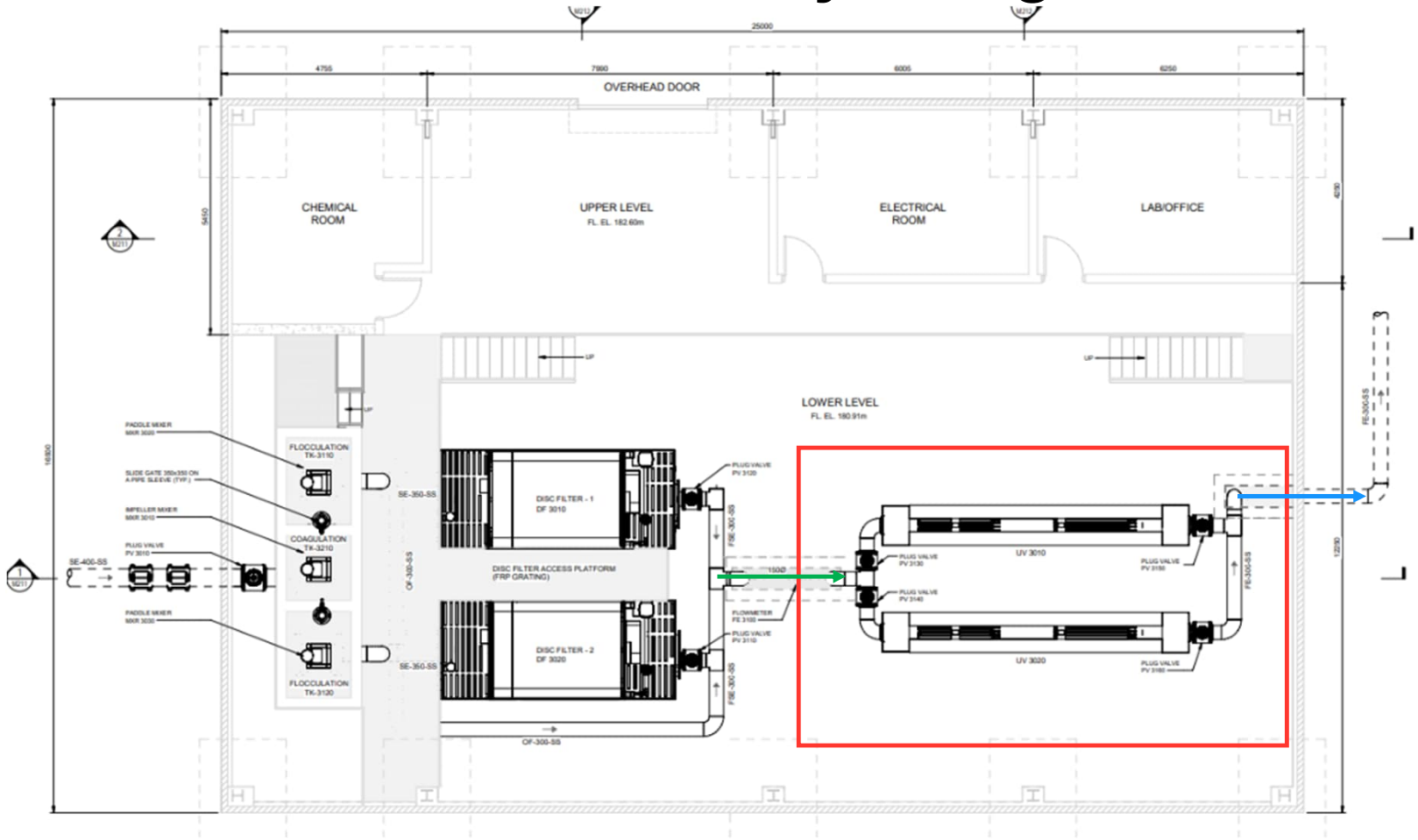
- **Option 2: UV Disinfection determined to be preferred Option**
- Ease of implementation/construction
- Simple to operate – no additional daily sampling
- Low Capital and O&M Cost
- No disinfection byproducts/toxicity and Supported by current regulatory context

Disinfection: Preliminary Design Overview

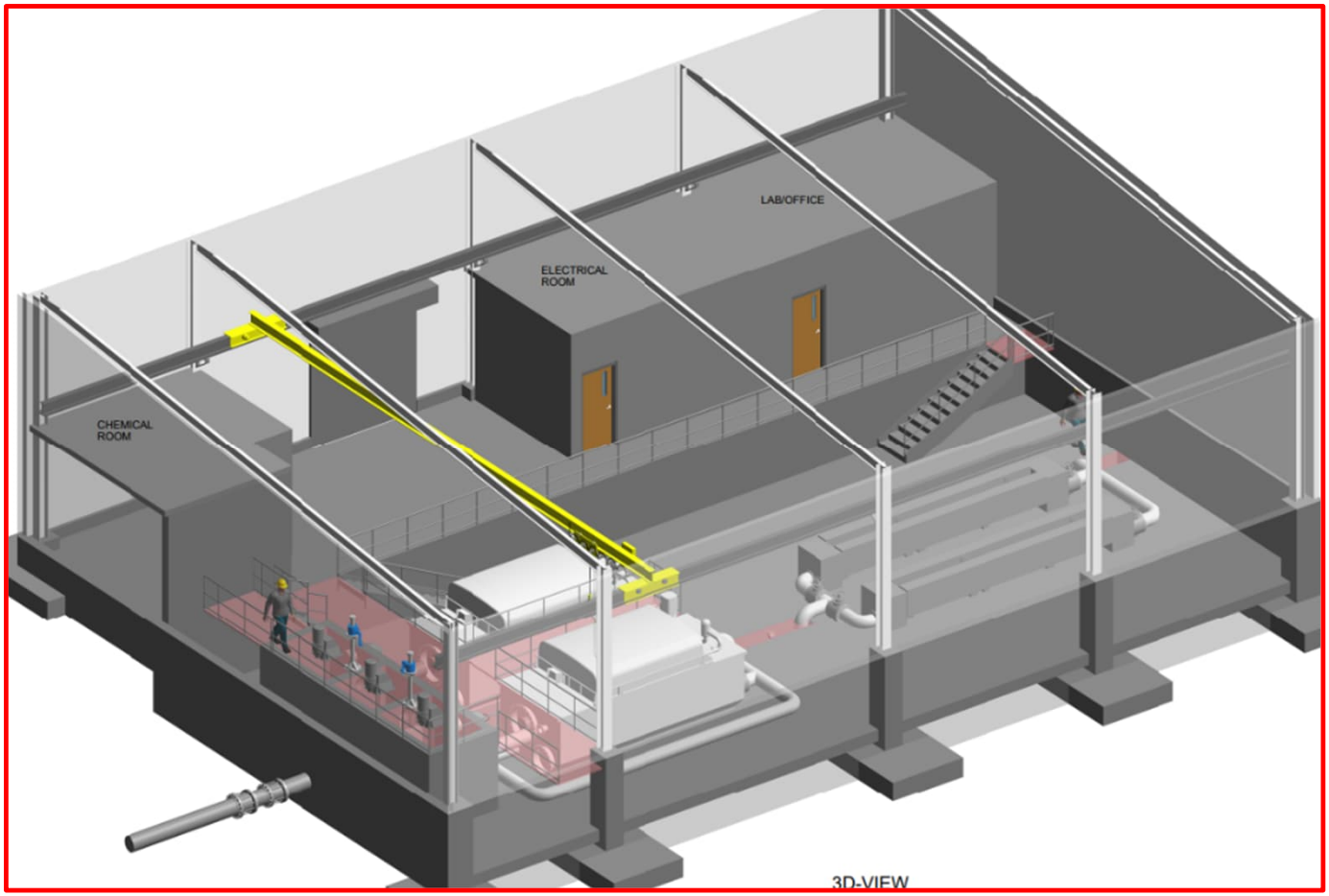




Disinfection: Preliminary Design Overview



Disinfection: Preliminary Design Overview



PRELIMINARY DESIGN RECAP AND 3D MODEL RENDERINGS

NEXT STEPS

STP UPGRADES
NEXT STEPS AND ANTICIPATED TIMELINE

1. Approval and Initiation of Detailed Design Oct 2025
2. Complete Environmental Impact Study (Jan 2026)
3. Mid 2026 Finalize Equipment Selection and initiate pre-purchase (Apr 2026)
4. Finalize Detailed Design (Sep 2026)
5. Submit Final MWR Registration Package** (Oct 31, 2026)
6. Submit Section 40 Approval to Start Construction** (Nov 2026)
7. Construction Tendering (Nov-Dec 2026)
8. Contract Award and Construction Start (Feb 2027)
9. Construction Completion before Mach 31, 2028 (Grant Funding Deadline)

INTERIM MONITORING AND COMPLIANCE NEXT STEPS

1. STP Met new permit requirements in August and September 2025
2. Contingency Plan In place
3. Complete Data Review and Determine any additional measures for 2026 (October 2025)

THANK YOU

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